AMENDMENTS TO THE CLAIMS

The following is a complete, marked up listing of revised claims with a status identifier in parentheses, underlined text indicating insertions, and strikethrough and/or double-bracketed text indicating deletions.

LISTING OF CLAIMS

1. (PREVIOUSLY PRESENTED) A method of forming a nickel silicide layer on an exposed silicon surface comprising:

depositing a nickel alloy layer on the exposed silicon surface, the nickel alloy including nickel and an alloying metal that constitutes no more than about 10 atomic percent of the nickel alloy;

reacting the nickel alloy layer with the exposed silicon surface to form a nickel silicide layer having an upper layer and a lower layer, wherein the alloying metal is preferentially segregated in the upper layer.

2. (ORIGINAL) A method of forming a nickel silicide layer according to claim 1, wherein:

the lower layer includes at least 95 atomic percent nickel and silicon.

3. (ORIGINAL) A method of forming a nickel silicide layer according to claim 2, wherein:

the lower layer includes at least 99 atomic percent nickel and silicon.

4. (ORIGINAL) A method of forming a nickel silicide layer according to claim 3, wherein:

the nickel and silicon are present in the lower layer in an atomic ratio of about 1.

5. (ORIGINAL) A method of forming a nickel silicide layer according to claim 1, further comprising:

forming a capping layer on the nickel alloy layer before reacting the nickel alloy with the exposed silicon.

6. (PREVIOUSLY PRESENTED) A method of forming a nickel silicide layer according to claim 5, wherein: the capping layer includes a major portion of titanium nitride.

7. (PREVIOUSLY PRESENTED) A method of forming a nickel silicide layer according to claim 1, wherein: the alloying metal is at least one metal selected from a group consisting of tantalum, vanadium, zirconium, hafnium, tungsten, cobalt, platinum, chromium, palladium, niobium and combinations thereof.

8. (PREVIOUSLY PRESENTED) A method of forming a nickel silicide layer according to claim 1, wherein:

the alloying metal is tantalum and is present in a concentration of at least about 0.1 atomic percent of the nickel alloy.

9. (ORIGINAL) A method of forming a nickel silicide layer according to claim 8, wherein:

the nickel alloy consists essentially of nickel and tantalum, the tantalum being present in an amount between about 0.1 and about 5 atomic percent.

10. (ORIGINAL) A method of forming a nickel silicide layer according to claim 5, wherein: the capping layer has a nitrogen:titanium atomic ratio of at least about 0.5.

11. (ORIGINAL) A method of forming a nickel silicide layer according to claim 6, wherein: the lower layer has a first thickness; and

the upper layer has a second thickness, wherein the first thickness is at least 70% of a sum of the first thickness and the second thickness.

12. (ORIGINAL) A method of forming a nickel silicide layer according to claim 6, wherein: the lower layer has a first thickness; and

the upper layer has a second thickness, wherein the first thickness is at least 85% of a sum of the first thickness and the second thickness.

13. (ORIGINAL) A method of forming a nickel silicide layer according to claim 12, wherein: the lower layer has a tantalum concentration no greater than about 4.9 atomic percent; and

the upper layer has a tantalum concentration of at least about 5 atomic percent.

14. (ORIGINAL) A method of forming a nickel silicide layer according to claim 12, wherein: the lower layer has a tantalum concentration no greater than about 0.5 atomic percent; and

the upper layer has a tantalum concentration no greater than about 60 percent.

15. (PREVIOUSLY PRESENTED) A method of manufacturing a semiconductor device comprising: defining an active region on a semiconductor substrate; forming a gate electrode in the active region;

exposing a silicon surface on the semiconductor substrate;

forming a nickel alloy layer on the semiconductor substrate, the nickel alloy including nickel and an alloying metal that constitutes no more than about 10 atomic percent of the nickel alloy;

reacting a portion of the nickel alloy layer with the exposed silicon surface to form a nickel silicide region; and

removing an unreacted portion of nickel alloy layer from the semiconductor substrate;

wherein the nickel silicide region includes an upper layer and a lower layer, and further wherein the alloying metal is preferentially segregated into the upper layer.

16. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein:

nickel and silicon represent at least about 95 atomic percent of the lower layer of the nickel silicide region.

17. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 16, wherein:

nickel and silicon represent at least about 99 atomic percent of the lower layer of the nickel silicide region.

18. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein:

the lower layer of the nickel silicide region includes nickel atoms and silicon atoms in a ratio of between about 9:10 and 10:9.

19. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, further comprising:

forming a capping layer on the nickel alloy layer;

maintaining the capping layer until the nickel silicide region has been formed; and removing the capping layer.

20. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 18, wherein:

the capping layer includes a major portion of TiN.

21. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein exposing the silicon surface on the semiconductor substrate includes:

exposing portions of the semiconductor substrate in a source/drain region formed in the active region.

22. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, further comprising:

forming a gate capping layer on the gate electrode to protect an upper surface of a polysilicon layer included in the gate electrode.

23. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein exposing silicon surfaces on the semiconductor substrate includes:

exposing silicon surfaces only on the gate electrode.

24. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 23, further comprising:

forming an insulating layer on the semiconductor substrate and the gate electrode; and

removing an upper portion of the insulating layer to expose a silicon surface on the gate electrode with a lower portion of the insulating layer covering source/drain regions formed in the active region.

25. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein exposing silicon surfaces on the semiconductor substrate includes:

exposing silicon surfaces in source/drain regions formed in the active region; and exposing a silicon surface on the gate electrode.

26. (PREVIOUSLY PRESENTED) A method of manufacturing a semiconductor device according to claim 15, wherein:

the alloying metal is at least one metal selected from a group consisting of tantalum, vanadium, zirconium, hafnium, tungsten, cobalt, platinum, chromium, palladium, niobium and combinations thereof.

27. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 26, further comprising:

forming a capping layer on the nickel alloy layer;

maintaining the capping layer until the nickel silicide region has been formed; and

removing the capping layer.

28. (PREVIOUSLY PRESENTED) A method of manufacturing a semiconductor device according to claim 15, wherein:

the alloying metal consists essentially of tantalum.

29. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 28, wherein:

tantalum constitutes no more than about 5 atomic percent of the nickel alloy.

30. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein reacting the nickel alloy with the exposed silicon surfaces to form nickel silicide regions on the semiconductor substrate includes:

heating the substrate and the nickel alloy layer to a temperature between about 250° C. and about 550° C. for a silicidation period of between about 10 seconds and about 30 minutes.

31. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, further comprising:

completing the manufacture of the semiconductor device utilizing processes such that at least about 90 percent of the nickel silicide region remains nickel monosilicide, NiSi.

32. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 31, wherein:

the nickel silicide region contains substantially no nickel disilicide, $NiSi_2$.

33. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein:

the lower layer has a first thickness;

the upper layer has a second thickness; and

the first thickness is at least 70% of a sum of the first thickness and the second thickness.

34. (ORIGINAL) A method of manufacturing a semiconductor device according to claim 15, wherein:

the lower layer has a first thickness;

the upper layer has a second thickness; and

the first thickness is at least 85% of a sum of the first thickness and the second thickness.

35-37. (CANCELED)

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